



# **STATE MINING AND GEOLOGY BOARD**

## **EXECUTIVE OFFICER'S REPORT**



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**For Meeting Date: May 14, 2009**

### **Agenda Item No. 8: Consideration of Amendment to Title 14 California Code of Regulations, Article 9, Section 3704, Pertaining to Slope Stability.**

**INTRODUCTION:** The State Mining and Geology Board has assumed certain administrative obligations and responsibilities of a lead agency pursuant to the Surface Mining and Reclamation Act of 1975 (SMARA) for forty-eight (48) individual surface mining operations located in two counties (El Dorado County and Yuba County), twelve (12) San Francisco Bay dredging operations within the Bay Conservation and Development Commission (BCDC), and ten (10) cities that do not have mining ordinances. Within the SMGB's jurisdiction, several surface mining sites have presented unique challenges in regards to the reclamation of cut slopes and/or fill slopes, that for a variety of reasons are considered unstable, and to reclaim such sites in a manner consistent with the SMGB's regulations, would have a significant adverse impact on the surface mining operation and/or adjacent properties. The SMGB's regulations (California Code of Regulations (CCR) Section 3704(f)) require that all cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use. Similarly, the SMGB's regulations (CCR Section 3704(d)) require that all final reclaimed fill slopes, including permanent piles or dumps of mine waste rock and overburden, shall not exceed 2:1 (horizontal:vertical), except when site-specific analysis demonstrate that the proposed final slope will have a minimum slope stability factor of safety that is suitable for the proposed end use, and when the proposed final slope can be successfully revegetated. The SMGB is discussing whether it wishes to consider hazard mitigation as a viable approach, in lieu of reclamation, when faced with such conditions.

### **REGULATORY AUTHORITY:**

Public Resources Code (PRC) Section 2733 defines "reclamation" as:

*"Reclamation" means the combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic or wildlife habitat, flooding, erosion, and other adverse effects from surface mining operations, including adverse surface effects incidental to underground mines, so that mined lands are reclaimed to a usable condition which is*



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*readily adaptable for alternate land uses and create no danger to public health or safety. The process may extend to affected lands surrounding mined lands, and may require backfilling, grading, resoiling, revegetation, soil compaction, stabilization, or other measures.”*

In regards to cut slopes, including final highwalls and quarry faces, performance standards, as provided in the SMGB’s regulations (CCR Section 3704(f)), require that:

*“Cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use.”*

Similarly, with regards to fill slopes, performance standards, as provided in the SMGB’s regulations (CCR 3704(d)), require that:

*“Final reclaimed fill slopes, including permanent piles or dumps of mine waste rock and overburden, shall not exceed 2:1 (horizontal:vertical), except when site-specific geologic and engineering analysis demonstrate that the proposed final slope will have a minimum slope stability factor of safety that is suitable for the proposed end use, and when the proposed final slope can be successfully revegetated.”*

CCR Section 3502(b)(3) states, in part:

*“The designed steepness and proposed treatment of the mined lands’ final slopes shall take into consideration the physical properties of the slope material, its probable maximum water content, landscaping requirements, and other factors. In all cases, reclamation plans shall specify slope angles flatter than the critical gradient for the type of material involved.”*

CCR Section 3501 defines Critical Gradient as:

*“The maximum stable inclination of an unsupported slope under the most adverse conditions that it will likely experience, as determined by current engineering technology.”*

CCR Section 3700(b) states:

*“Where an applicant demonstrates to the satisfaction of the lead agency that an exception to the standards specified in this article is necessary*



*based upon the approved end use, the lead agency may approve a different standard for inclusion in the approved reclamation plan. Where the lead agency allows such an exception, the approved reclamation plan shall specify verifiable, site-specific standards for reclamation. The lead agency may set standards which are more stringent than the standards set forth in this Article; however, in no case may the lead agency approve a reclamation plan which sets any standard which is less stringent than the comparable standard specified in this Article.”*

**DISCUSSION:** California Geological Survey Special Publication SP117A, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, dated 2008, provides three general means in which earthquake induced hazards can be treated. These means are:

1. **Avoid the Hazard:** Where the potential for failure is beyond an acceptable level of safety during the life of the project and not preventable by practical means, the hazard should be avoided. Developments should be built sufficiently far away from the threat that they will not be affected by potential offsite failures. Proposed development areas at or near the base of unstable slopes should be avoided and relocated to areas where stabilization is feasible;
2. **Reduce the Hazard to an Acceptable Level:** Several techniques can be used to increase the factor of safety to a level that is acceptable to the local permitting agency. The commonly accepted factor of safety for slopes is greater than 1.5 for static and greater than 1.1 for dynamic loads; and,
3. **Accommodate the hazard:** Where conditions exist that will cause some measurable amount of strain, engineering techniques based on performance can be used to accommodate the stress. Reducing the hazard may not ensure that the project will remain stable indefinitely; however, the continued success of mitigation often depends on timely inspection, maintenance and ongoing repair.

The SMGB's regulations, CCR Sections 3704(d) and 3704(f), only recognize approach No. 2 as provided in SP117A. In other words, SMARA requires that all final reclaimed slopes shall have a minimum slope stability factor of safety that is suitable for the proposed end use. Furthermore, such slopes should be stable as determined by current engineering technology. Other mitigation means, notably, approach Nos. 1 and 3 as provided in SP117A, are considered by some as applicable, or should be applicable, for failed or unstable slopes encountered at surface mine sites. Such strategies may incorporate end use restrictions, setbacks, placement of berms, catchment basins, and long-term monitoring



and maintenance. In addition, despite these efforts, the subject slope remains in an unstable form, and over time, reclamation of such slope for future development considerations are passed on to the developer, not the operator that caused the problem in the first place. Furthermore, if SP117A approach Nos. 1 and 3 were considered applicable, then two questions are raised. First, would the mine operator realize an unfair advantage since the requirements for reclamation are reduced? Second, would having an avoidance or accommodation mitigation alternative generate an environment where mine operators would use such option as a fallback position, as opposed to mining in a responsible manner so as to avoid creating adverse slope conditions that warrant such consideration? Finally, SP117A approach Nos. 1 and 3 are not reclamation as currently defined in SMARA.

The SMGB recently has had such considerations before it, and will have two such cases before it this year. Three pertinent case examples are briefly summarized below:

Scenario No. 1: The Pt. Richmond (Canal) Quarry, located in the City of Richmond, recently dealt with mitigation of complex failures of a rock cut slope with vertical dimensions of approximately 200 feet. The solution in this case, which was incorporated into an amended reclamation plan approved by the SMGB in November of 2007, involved a combination of engineered fill slope buttress construction and rock bolt installation. Acceptable static and pseudo-static factors of safety were calculated based on the approved slope mitigation for a range of possible end uses at this site, including industrial, office building, and tank farm. The approved financial assurance mechanism for reclamation of the Point Richmond (Canal) Quarry, which included the approved slope repair and other reclamation activities, was in the amount of \$3.1 million. Reclamation of this site is currently over 90 percent complete.

Scenario No. 2: The Richmond (Chevron) Quarry is also located in the City of Richmond, and encompasses approximately 126 acres. The site is characterized by a flat quarry floor, a hide wall constructed from fill material, and unstable quarry cut slopes with vertical dimensions of up to approximately 350 feet. A consultant's report described the following slope mitigation alternatives to address the stability of the failed portions of the cut slope, and provided the estimated costs per alternative:

Alternative 1 – Imported Fill Buttress	\$20,441,250
Alternative 2 – Ridge Cut\Fill Buttress Balanced on Site	\$2,481,125
Alternative 3 – Cut\Fill Buttress Balanced on Site with Retained Slope	\$7,590,000
Alternative 4 – Structural Slope Stabilization	\$19,780,000
Alternative 5 – Slope Setback, Monitoring, and Maintenance	\$550,000



Based on the consultant's analysis, it appears that implementation of any one of Alternatives 1 through 4 would result in a stable quarry slope that would be consistent with SMGB regulations. Alternative 5 contemplates a combination of 1) a deed-restricted open space end use designation for the quarry slope and 100-foot setback area at the toe of the slope, 2) construction of a rock fall catchment structure within the setback area, 3) long-term (30 years) geotechnical and revegetation monitoring of the slope, and 4) periodic maintenance of the slope and catchment structure as needed. Although it appears that implementation of Alternative 5 would result in a safe industrial end use for a large portion of the existing quarry floor, it is not compatible with the SMGB regulations requiring final cut slopes to be stable.

The 350-foot high cut slope is deemed unstable. Reclaiming such slope in accordance with SMARA and the SMGB's regulations is claimed by the operator to be unreasonably expensive and expected to have a significant adverse impact on adjacent lands.

Scenario No. 3: The Super Creek Quarry (formerly Painted Hills Mine), within the City of Desert Hot Springs, has produced decorative rock with sand as a by-product since about 1954. The site is located approximately 3.5 miles north of the existing Whitewater Rock and Supply retail site adjacent to Interstate 10, and is accessed by an existing Bureau of Land Management (BLM) right-of-way, which runs along the ridge immediately east of the south-flowing Whitewater River. The ridge-top mine site is surrounded by land managed by the BLM, and is bordered on the northeast and southeast by the meandering and intermittent southerly-flowing Super Creek. A BLM access/haul road that parallels Super Creek defines the toe of the mining operations east-southeast facing tailings slopes.

Existing pre-SMARA tailing slopes exist on the northeastern flank of the quarry, and immediately northeast of the access road to the quarry. Sheet 1 of 1 of the 1993 Revised Supplement to the Reclamation Plan denotes Post-SMARA, Present and Future Tailings areas. These tailing slopes are approximately 300 feet in height, and are inclined as steep as 1.7H:1V (31 degrees from the horizontal). Field measurements of tailings slope gradients during recent annual inspections ranged from approximately 30 to 34 degrees.

The tailings slopes are deemed unstable, and erosion from such slopes has resulted in delivery of sediment to Super Creek. During late 2008, the operator installed a series of sediment catchment basins along the access road at the toe of the tailings slopes in order to prevent continued delivery of sediment to Super Creek. Although these catchment basins appear to be generally successful, they require constant maintenance in order to remain effective, and they do not constitute reclamation of the tailings slopes themselves. The mine operator and his representatives assert that reclaiming such slopes in accordance with SMARA and the SMGB's current regulations will have a significant adverse impact on the operator's ability to continue mining.



**EXECUTIVE OFFICER'S RECOMMENDATION:** Reclamation reduces adverse surface effects so that mined lands are reclaimed to a usable condition which is readily adaptable for alternate land uses and create no danger to public health or safety, including stabilization of unstable slopes. It is the opinion of the Executive Officer that hazard avoidance or accommodation, as it pertains to surface mine slopes, is not reclamation. In other words, mine slope reclamation is not entirely compatible with CGS SP 117A, as revised and re-adopted by the SMGB on September 11, 2008. Furthermore, consideration of alternative slope mitigation measures with regards to final reclaimed mine slopes would also set precedent. The Executive Office is requesting guidance from the SMGB as to whether the SMGB wishes to consider hazard avoidance or accommodation, as a mitigation alternative to reclamation, when considering appropriate measures for mitigation of unstable slopes on surface mine sites.

Should such consideration be preferred, a regulatory change would be required. Such language could be initially considered by the Policy and Legislation Committee. No recommendation is offered at this time.

**SUGGESTED MOTION LANGUAGE:** The Executive Officer offers the following motions for the SMGB's consideration:

Motion No. 1 – To direct this matter to the Committee for further discussion:

*Mr. Chairman, in light of the information before the SMGB today, I move that the Board direct this matter to the Policy and Legislation Committee for further discussion.*

Or,

Motion No. 2 – To not consider amending CCR Section 3704:

*Mr. Chairman, in light of the information before the SMGB today, I move that the Board not consider avoidance or accommodation in the mitigation of slopes at surface mine sites.*

Respectfully submitted:

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Executive Officer